

force perpendicular to the surface so as to produce a preload adhesive force of between about 0.01 and 0.10 grams. The flexible beam is used to orient the seta parallel to the surface while maintaining the preload force. The seta may be pulled by the flexible beam at a velocity to increase the adhesive force exerted by the seta on the surface.

Applicant's invention, in another configuration, is directed to a method of establishing an adhesive force wherein a flexible beam is used to apply a plurality of protrusions on a supporting structure to a surface with a force perpendicular to the surface so as to produce a preload adhesive force of between about 0.01 and 0.10 grams. The flexible beam is used to orient the protrusions parallel to the surface while maintaining the preload force. The protrusions may be pulled by the flexible beam at a velocity to increase an adhesive force exerted by the protrusions on the surface.

The flexible beam provides for an improved device. It controls preload and orientation of the seta or protrusions. It produces the appropriate preload force while maintaining the desired parallel alignment of the seta or protrusions with the surface to which they are applied. (See Applicant's specification page 25, lns. 9-22).

### **The Cited Art**

Full et al. discloses a manipulator 200. The manipulator includes a beam 202 with a set of setae 26A-26D arranged in opposing pairs. The beam 202 is pushed toward the substrate to preload and spread the setae. The beam is pulled away from the substrate to drag and pick-up the substrate. The beam is pushed toward the substrate to release the setae. (Col. 9, line 66 to Col. 10, line 8 of U.S. Patent 6,737,160).

### **The Standard of Obviousness**

Three criteria must be met to establish obviousness. First, the prior art must provide one of ordinary skill in the art with a suggestion or motivation to modify or combine the teachings of the references relied upon in rejecting the claims. Second, the prior art must provide one of

ordinary skill in the art with a reasonable expectation of success. Third, the prior art, either alone or in combination, must teach or suggest each and every limitation of the rejected claims. The teaching or suggestion to make the claimed invention, as well as the reasonable expectation of success, must come from the prior art and not from Applicant's disclosure. If any one of these criteria is not met, a case of obviousness is not established.

**Applicant's Invention Would Not Have Been Obvious**

Applicant's invention would not have been obvious in view of Full et al. Full et al. simply does not teach or suggest each and every limitation of the rejected claims.

Full et al. does not disclose using a flexible beam to apply a seta or protrusions to a surface with a force perpendicular to the surface so as to produce a preload adhesive force of between about 0.01 and 0.10 grams. Additionally, Full et al. does not disclose using a flexible beam to orient the seta or protrusions parallel to a surface while maintaining the preload force. Further, Full et al. does not disclose using these techniques to manipulate a plurality of protrusions on a supporting structure. Moreover, Full et al. does not disclose using a flexible beam to pull a seta or a plurality of protrusions at a velocity to increase an adhesive force exerted by a seta or protrusions on a surface. The flexible beam of Applicant's invention produces the appropriate preload force while maintaining a substantially parallel alignment of the seta or protrusions with a surface to which they may be applied.

Full et al., alone or in combination, neither teaches nor suggests each and every limitation of the rejected claims. As pointed out, Full et al., contains absolutely no disclosure of a flexible beam used to apply a seta to a surface with a force perpendicular to the surface so as to produce a preload adhesive force of between about 0.01 and 0.10 grams. Thus, for this reason alone, Applicant's claimed invention would not have been obvious in view of Full et al.

Furthermore, there is no disclosure in Full et al. that the beam 202 of the manipulator 200 is a flexible beam. Full et al. is simply silent as to whether the beam 202 is flexible or not. An obvious rejection cannot be based on such a lack of disclosure. Indeed, in the context of the Full et al. disclosure, it appears that the beam 202 was a rigid beam. The disclosure of Full et al. is like the disclosures in the references: Autumn et al. article from Nature, entitled “Adhesive force of a single gecko foot-hair” (“Autumn et al.”) and the Liang article from Solid State Sensor and Actuator Workshop, entitled “Adhesion Force Measurements on Single Gecko Setae” (“Liang et al.”), previously cited by the examiner.

As previously discussed, the pin of Autumn et al. and Liang et al. is not a flexible beam that is used to apply a seta or a plurality of protrusions in such a way as to preload an adhesive force of the seta or protrusions and orient the seta or protrusions parallel to a surface. Rather, in Autumn et al. and Liang et al., the pin is a rigid rod that functioned as a rigid base for a single setae. (Autumn Declaration of September 15, 2005, paragraphs 9-11, a copy of which is attached).

The forces generated by preloading a single gecko setae were much too small to cause any real deflection of the pin. That is, under any operational load or preload, the change in position or orientation of the pin with loading is negligible compared with its unloaded configuration. (Autumn Declaration, paragraphs 12-13).

The flexible beam of Applicant’s invention provides a new layer of compliance above a seta or an array of protrusions. The flexible beam yields proper preload of a setal array or protrusions while maintaining substantially parallel alignment of the setal array or protrusions with a surface. The flexible beam is designed such that under any operational load or preload, the loading of the beam acts to deflect it to a new position and orientation which improves engagement. (Autumn Declaration, paragraph 14).

Additionally, as noted, Full et al. does not disclose using a flexible beam to orient a seta parallel to a surface while maintaining the designated preload force. Rather, in Full et al., the "initial perpendicular force need not be maintained during the subsequent pull." (Col. 4, lines 26-29 and Col. 6, lines 61-63 of U.S. Patent 6,737,160).

As such, for at least these reasons, Applicant's invention would not have been obvious in view of Full et al.

**Conclusion**

In view of the foregoing, it is submitted that all the claims are now in condition for allowance. Accordingly, allowance of the claims at the earliest possible date is requested.

If prosecution of this application can be assisted by telephone, the Examiner is requested to call Applicant's undersigned attorney at (510) 267-4106.

Please apply any other charges or credits to deposit account number 50-388 (Order No. LEWIP001).

Dated: 2/5/07

Respectfully submitted,  
BEYER WEAVER & THOMAS, LLP



William J. Egan, III  
Reg. No. 28,411

P.O. Box 70250  
Oakland, CA 94612-0250